APPENDIX K: GLOSSARY OF TERMS AND CONCEPTS

Concepts and definitions: http://science.nature.nps.gov/im/monitor/glossary.cfm

Adaptive Management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form-"active" adaptive management-employs management programs that are designed to experimentally compare selected policies or practices, by implementing management actions explicitly designed to generate information useful for evaluating alternative hypotheses about the system being managed.

Attributes are any living or nonliving feature or process of the environment that can be measured or estimated and that provide insights into the state of the ecosystem. The term **Indicator** (see below) is reserved for a subset of attributes that is particularly information-rich in the sense that their values are somehow indicative of the quality, health, or integrity of the larger ecological system to which they belong (Noon 2002).

A **Conceptual Model** is a visual or narrative summary that describes the important components of the ecosystem and the interactions among them. Development of a conceptual model helps in understanding how the diverse components of a monitoring program interact, and promotes integration and communication among scientists and managers from different disciplines. Conceptual model diagrams often take the form of a "boxes and arrows" diagram, whereby mutually exclusive components are shown in boxes and interactions among the components are shown with arrows, but many conceptual models include tables, matrices, sentences or paragraphs to summarize and communicate our understanding of the system.

Ecological integrity is a concept that expresses the degree to which the physical, chemical, and biological components (including composition, structure, and process) of an ecosystem and their relationships are present, functioning, and capable of self-renewal. Ecological integrity implies the presence of appropriate species, populations and communities and the occurrence of ecological processes at appropriate rates and scales as well as the environmental conditions that support these taxa and processes.

Ecosystem is defined as, "a spatially explicit unit of the Earth that includes all of the organisms, along with all components of the abiotic environment within its boundaries" (Likens 1992).

Ecosystem drivers are major external driving forces such as climate, fire cycles, biological invasions, hydrologic cycles, and natural disturbance events (e.g., earthquakes, droughts, floods) that have large scale influences on natural systems.

Ecosystem management is the process of land-use decision making and land-management practice that takes into account the full suite of organisms and processes that characterize and comprise the ecosystem. It is based on the best understanding currently

available as to how the ecosystem works. Ecosystem management includes a primary goal to sustain ecosystem structure and function, a recognition that ecosystems are spatially and temporally dynamic, and acceptance of the dictum that ecosystem function depends on ecosystem structure and diversity. The whole-system focus of ecosystem management implies coordinated land-use decisions.

Focal resources are park resources that, by virtue of their special protection, public appeal, or other management significance, have paramount importance for monitoring regardless of current threats or whether they would be monitored as an indication of ecosystem integrity. Focal resources might include ecological processes such as deposition rates of nitrates and sulfates in certain parks, or they may be a species that is harvested, endemic, alien, or has protected status.

Indicators are a subset of monitoring attributes particularly information-rich in the sense that their values are somehow indicative of the quality, health, or integrity of the larger ecological system to which they belong (Noon 2002). Indicators are a selected subset of the physical, chemical, and biological elements and processes of natural systems that are selected to represent the overall health or condition of the system.

Inventory: A natural resource inventory is an extensive point-in-time effort to determine location or condition of a resource, including the presence, class, distribution, and status of plants, animals, and abiotic components such as water, soils, landforms, and climate. Inventories contribute to a statement of park resources, which is best described in relation to a standard condition such as the natural or unimpaired state. Inventories may involve both the compilation of existing information and the acquisition of new information. They may be relative to either a particular point in space (synoptic) or time (temporal).

Measures are the specific variables used to quantify the condition or state of an Attribute or Indicator. These are specified in definitive sampling protocols. For example, stream acidity may be the indicator, while pH units are the measure.

Monitoring differs from inventory in adding the dimension of time, and the general purpose of monitoring is to detect changes or trends in a resource (Elzinga et al. 1998). defined monitoring as "The collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective". Detection of a change or trend may trigger a management action, or it may generate a new line of inquiry. Monitoring is often done by sampling the same sites over time, and these sites may be a subset of the sites sampled for the initial inventory.

Natural resource monitoring is conducted primarily for two purposes: (1) to detect significant changes in resource abundance, condition, population structure, or ecological processes; or (2) to evaluate the effects of some management action on population or community dynamics or ecological processes. Monitoring should have a specific purpose, and is a prerequisite for management action, which is triggered when values reach or

exceed some pre-determined threshold value. Monitoring cannot be a "I'll know it when I see it" process.

Monitoring data are most useful when the same methods are used to collect data at the same locations over a long time period (e.g. more than 10-12 years). It is important to note that cause and effect relationships usually cannot be demonstrated with monitoring data, but monitoring data might suggest a cause and effect relationship that can then be investigated with a research study. The key points in the definition of monitoring are that: (1) the same methods are used to take measurements over time; (2) monitoring is done for a specific purpose, usually to determine progress towards a management objective; and (3) some action will be taken based on the results, even if the action is to maintain the current management.

Monitoring Attributes are any living or nonliving feature or process of the environment that can be measured or estimated and that provide insights into the state of the ecosystem. The term indicator is reserved for a subset of attributes that is particularly information-rich in the sense that their values are somehow indicative of the quality, health, or integrity of the larger ecological system to which they belong (Noon 2002). Indicators are a selected subset of the physical, chemical, and biological elements and processes of natural systems that are selected to represent the overall health or condition of the system.

Research has the objective of understanding ecological processes and in some cases determining the cause of changes observed by monitoring. That understanding is needed for determining the appropriate management response to threats. Research is generally defined as the systematic collection of data that produces new knowledge or relationships and usually involves an experimental approach, in which a hypothesis concerning the probable cause of an observation is tested in situations with and without the specified cause. The NPS monitoring program includes a research component to design sampling protocols for various types of park resources at different locations and spatial scales.

Research is usually short term; approximately 80% of research studies last only 1-2 years, and 75% of studies involve only 1 or 2 species. An important exception to this generalization is the collaborative “Long-Term Ecological Research” program funded by the National Science Foundation, which is conducting long-term research on such things as pattern and control of primary production, spatial and temporal distribution of selected populations, and patterns of nutrient influx and movement through soils, groundwater and surface waters.

Protocols and standard operating procedures used by researchers are usually based on the latest technology and are often too time consuming or expensive to provide data for a long-term monitoring program. The need to publish results in peer-reviewed journals, the measure of successful research, tends to require researchers to continually develop new sampling methods and to debate alternate models and analyses.

Stressors are physical, chemical, or biological perturbations to a system that are either (a) foreign to that system or (b) natural to the system but applied at an excessive [or deficient] level (Barrett et al. 1976:192). Stressors cause significant changes in the ecological components, patterns and processes in natural systems. Examples include water withdrawal, pesticide use, timber harvesting, traffic emissions, stream acidification, trampling, poaching, land-use change, and air pollution.

Vital Signs are a subset of physical, chemical, and biological elements and processes of park ecosystems that are selected to represent the overall health or condition of park resources, known or hypothesized effects of stressors, or elements that have important human values. The elements and processes that are monitored are a subset of the total suite of natural resources that park managers are directed to preserve "unimpaired for future generations," including water, air, geological resources, plants and animals, and the various ecological, biological, and physical processes that act on those resources. Vital signs may occur at any level of organization including landscape, community, population, or genetic level, and may be compositional (referring to the variety of elements in the system), structural (referring to the organization or pattern of the system), or functional (referring to ecological processes). Because of the need to maximize the use and relevance of monitoring results for making management decisions, vital signs selected by parks may include elements that were selected because they have important human values (e.g., harvested or charismatic species) or because of some known or hypothesized threat or stressor/response relationship with a particular park resource.

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http://science.nature.nps.gov/im/monitor/Glossary.htm